Cavity-Less Caper

Daisy Dentifriss is very concerned about her teeth and takes very good care of them. She brushes twice a day and flosses once a day as her dentist has shown her. Now that she is on her own and must supply herself with the things she needs to keep her teeth bright, beautiful and forever in her mouth, she is wondering about the cost of her floss.

Daisy is now 20 years old, just out of college and supporting herself. She figures that she uses about 18 inches of dental floss every time she flosses her pearly whites with waxed floss, but when she used unwaxed, she uses about 22 inches. Every 6 months she visits her dentist for a check up. She gives Daisy a free package of dental floss containing 50 yards (waxed cinnamon flavored). Her mother, who is now 45 years old, puts a container of floss of 100 yards (unwaxed) in her stocking at Christmas each year.

In the store, she finds many types from which to choose.

Unwaxed, 63 yards @ $1.19
Waxed, mint or cinnamon, 50 yards @ $1.09
Waxed, 100 yards @ $2.49
Waxed mint, 100 yards @ $ .99
Unwaxed or waxed, 100 yards @ $ 1.39
Waxed, 200 yards @ $3.79
Natural flossing ribbon, 30 yards @ $3.59 (uses all natural ingredients including bees' wax)

How much money will Daisy Dentifriss spend on her dental floss in her lifetime?

Please record all choices you are considering along the way. How and why you made these decisions is also important for someone who is reading your paper. Remember you want to present this so it is readable, easy to understand and well documented with facts.

Have Fun!

Grade Levels 6 - 8

Cavity-Less Caper

Daisy Dentifriss is very concerned about her teeth and takes very good care of them. She brushes twice a day and flosses once a day as her dentist has shown her. Now that she is on her own and must supply herself with the things she needs to keep her teeth bright, beautiful and forever in her mouth, she is wondering about the cost of her floss.

Daisy is now 20 years old, just out of college and supporting herself. She figures that she uses about 18 inches of dental floss every time she flosses her pearly whites with waxed floss, but when she used unwaxed, she uses about 22 inches. Every 6 months she visits her dentist for a check up. She gives Daisy a free package of dental floss containing 50 yards (waxed cinnamon flavored). Her mother, who is now 45 years old, puts a container of floss of 100 yards (unwaxed) in her stocking at Christmas each year.

In the store, she finds many types from which to choose.

Unwaxed, 63 yards @ $1.19
Waxed, mint or cinnamon, 50 yards @ $1.09
Waxed, 100 yards @ $2.49
Waxed mint, 100 yards @ $ .99
Unwaxed or waxed, 100 yards @ $ 1.39
Waxed, 200 yards @ $3.79
Natural flossing ribbon, 30 yards @ $3.59 (uses all natural ingredients including bees' wax)

How much money will Daisy Dentifriss spend on her dental floss in her lifetime?

Please record all choices you are considering along the way. How and why you made these decisions is also important for someone who is reading your paper. Remember you want to present this so it is readable, easy to understand and well documented with facts.

Have Fun!

Context

This is an open problem that students can attack making their own assumptions and using their own strategies. Some students become very engaged as they proceed.

What This Task Accomplishes

As an open problem, it allows students to make their own assumptions and develop strategies for solving the problem. There is not one right answer or one appropriate strategy.

What the Student Will Do

Students will develop a strategy for attacking the problem, make assumptions (for example, how long the mother will live) and document their work as they determine how much Daisy will spend. Some students will take the solution much farther than others.

Time Required for Task

This was a problem which students did at home. They had one week to work on it.

Interdisciplinary Links

This unit can be tied to health education. However, it might be more useful to think of it as a problem that can teach students to use problem-solving strategies and tools as a means of becoming wiser consumers.

Teaching Tips

This is a problem that I do early in the year. I alert children to the fact that they will need to think carefully about the problem and that they may need to make some assumptions. Allow students to share their "solutions" so that they can compare strategies.

Suggested Materials

- Paper
- Pencil
- Calculator

Possible Solutions

There are many possible solutions depending on the assumptions that students make, but while the mother is alive dental floss should cost nothing or only a few cents (depending on whether or not she has her teeth flossed the days she goes to the dentist). Lifetime costs will depend on how long mom lives, whether the dentist continues to live and give her floss, and what type of floss she chooses to buy.

Benchmark Descriptors

Novice
There appear to be the elements of a rudimentary strategy, but it is not one that can lead to an appropriate response. The problem is not solved correctly or completely.

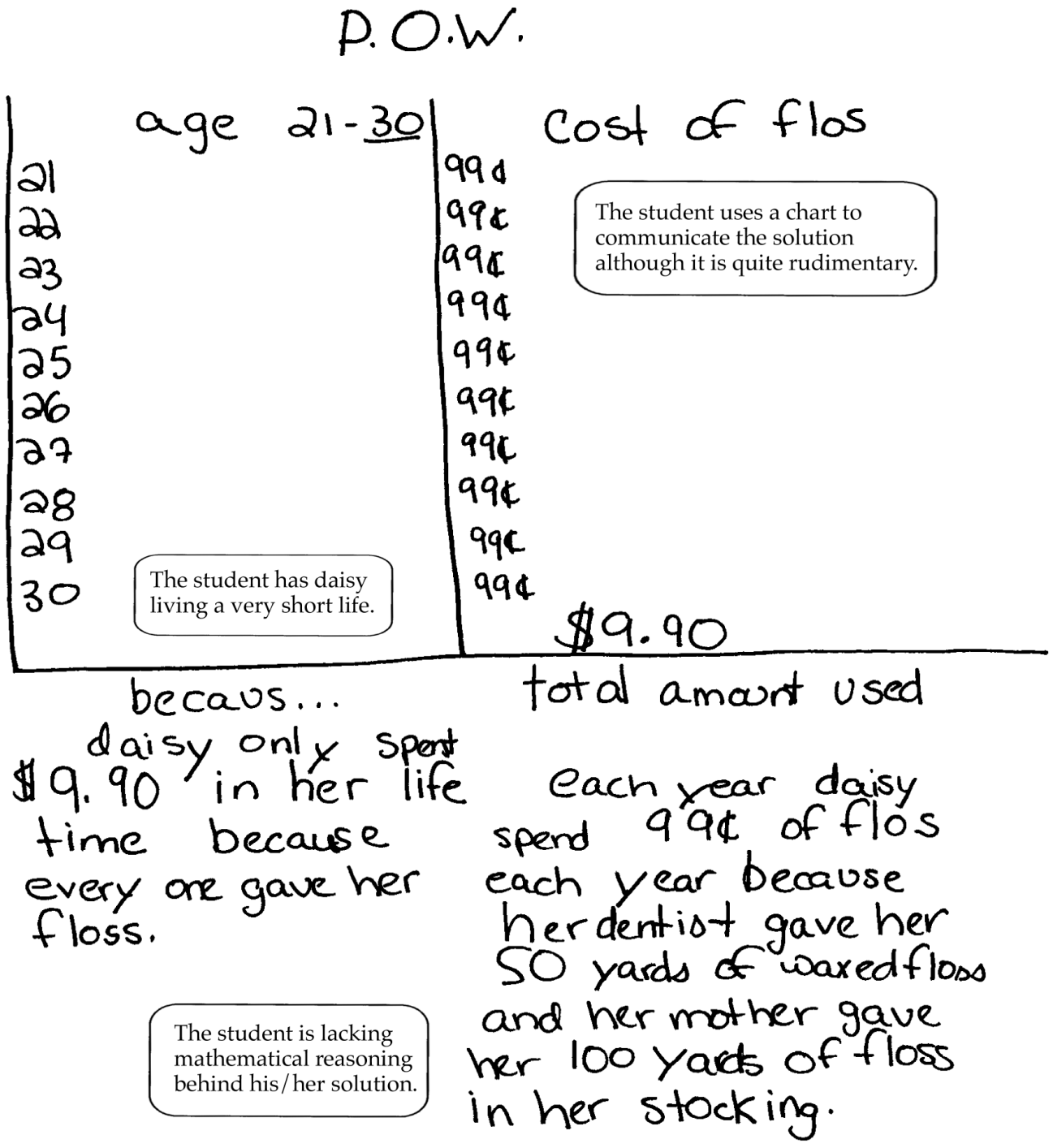
Apprentice
The student's beginning of this problem indicates that parts of it are understood and there is

some evidence of mathematical reasoning. However, the student made some incorrect assumptions and did not carry out mathematical procedures correctly. The student also dealt with only part of the question.

Practitioner
This is between Apprentice and Practitioner. The student clearly understands the problem and has an appropriate strategy leading to a solution. The explanation is quite clear. However, the student does not complete the last part of the problem, determining how much floss would cost over a lifetime.

Expert
The Expert had a clear understanding of the problem, used very efficient strategies and even went the extra mile to find the best buy for floss. The explanation is very clear and mathematical representation and terminology are appropriate.

Novice



The student uses a chart to communicate the solution although it is quite rudimentary.

The student has daisy living a very short life.

The student is lacking mathematical reasoning behind his/her solution.

Apprentice

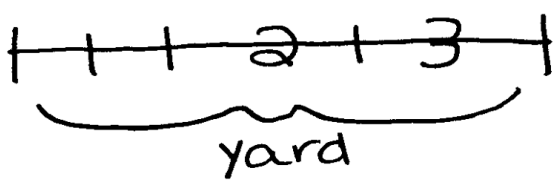
The student begins to solve the problem with a useful strategy.

The Cavity-Less Caper

1st I picked waxed mint 99¢ per 100 yards

how Daisy uses 18 inches of waxed each day.

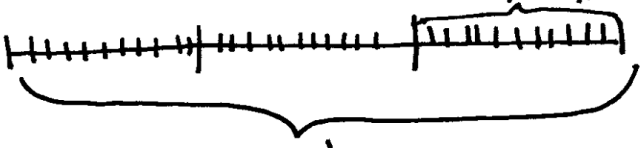
So I found out how many feet were in a yard



There are three feet in a yard

Then I found out how many inches were in 3 feet

12 x 3 = 36



36 inches in 3 feet in 1 yard

Then I multiplied 36 to 100 yards of mint waxed dental floss which gives you how many inches there are in 100 yards which is 3,600 inches. I then divided the 18 inches She uses each day to 3,600 →

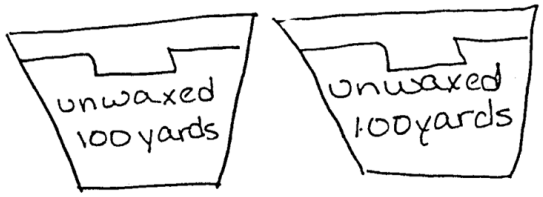
Apprentice

It is unclear why the student thinks s/he needs to use different types of floss.

inches so I would get how many days the 3,600 inches of dental floss would last her which came out to be 200 days. so 99¢ gave her 200 days of Dental floss. But still 200 days isn't a year, how am I going to make it last a year? Buy another one for 400 days all together.

= 400 days = 1 year and 35 days

Now for the unwaxed dental floss. I picked unwaxed 100 yards for $1.39. so to make it last a year I do the same thing as above.



= 400 days = 1 year and 35 days

Now if Daisy goes to the Dentist every 6 months and gets free waxed dental floss (50 yd.) and her mom gives her unwaxed (100 yds.) at christmas the floss

Diagrams are rudimentary and do not contribute to the student's communication.

Apprentice

from the dentist (since there are 12 months in a year and she goes to the Dentist 2 times a year) will last her 8 days for 6 month time period or for the whole year it will last her 17 days.
The unwaxed from her mother will last her 14 days (if she uses it everyday:)

So every year she is set with 100 yrds. of waxed which will last for 17 days, and 100 yrds. of unwaxed which will last for 14 days.

So Daisy is all set with 31 days of the year for free dental care.

Including the 1 year and 35 days of waxed and the 1 year and 35 days of unwaxed all together Daisy has about 2 years 3 months and 8 days of

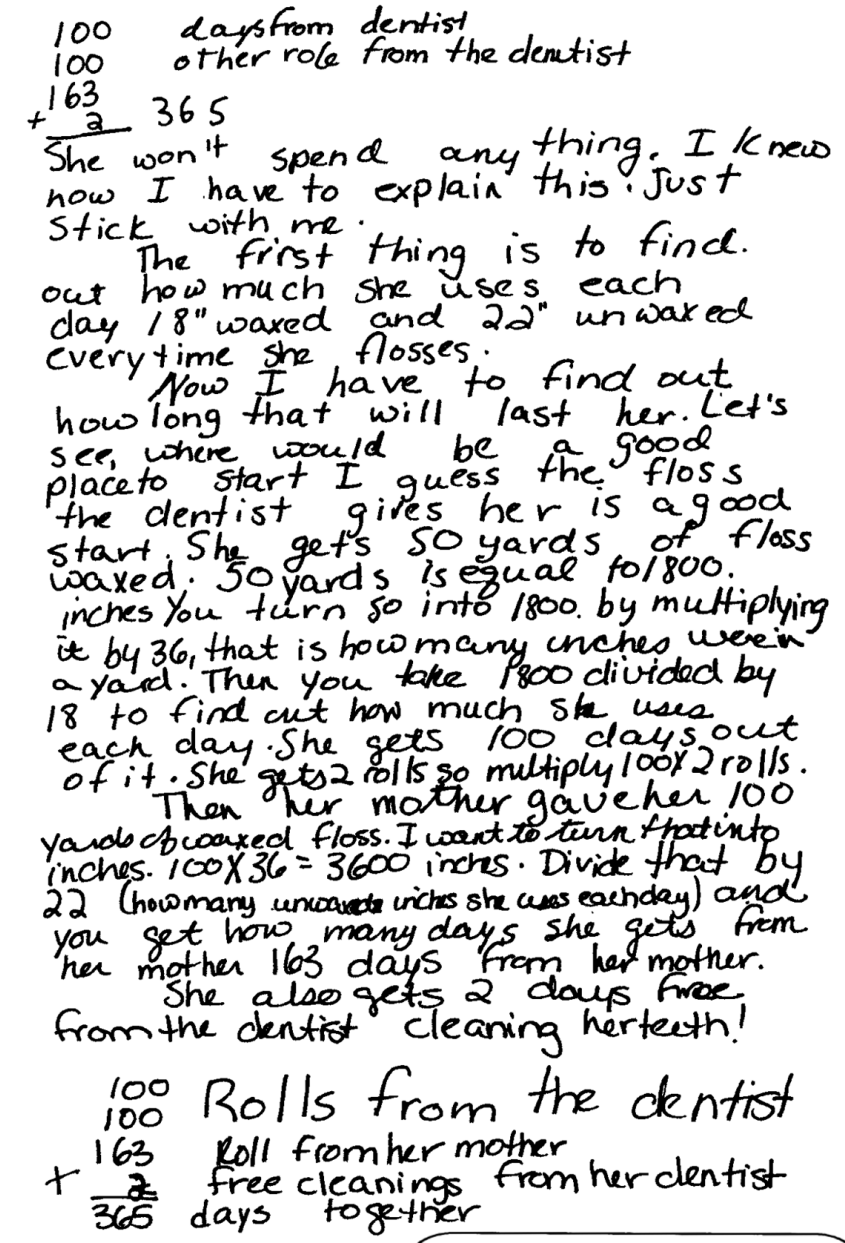
2 50 YARD CINNAMON WAXED
1 100 YARD UNWAXED
2 100Y mint waxed
2 100Yunwaxed

The student neglects to address the "lifetime" aspect of the problem.

Practitioner

The student clearly communicates an approach that would work.

The student labels his/her work.


100 days from dentist
100 other role from the dentist
+163
2 365
She won't spend anything. I knew now I have to explain this. Just stick with me.
The first thing is to find out how much she uses each day 18" waxed and 22" unwaxed every time she flosses.
Now I have to find out how long that will last her. Let's see, where would be a good place to start I guess the floss the dentist gives her is a good start. She gets 50 yards of floss waxed. 50 yards is equal to 1800. inches You turn so into 1800. by multiplying it by 36, that is how many inches were in a yard. Then you take 1800 divided by 18 to find out how much she uses each day. She gets 100 days out of it. She gets 2 rolls so multiply 100 X 2 rolls.
Then her mother gave her 100 yards of waxed floss. I want to turn that into inches. 100 X 36 = 3600 inches. Divide that by 22 (how many unwaxed inches she uses each day) and you get how many days she gets from her mother 163 days from her mother.
She also gets 2 days free from the dentist cleaning her teeth!
100 Rolls from the dentist
100
+163 Roll from her mother
2 free cleanings from her dentist
365 days together

To be a true "Practitioner" the student would need to calculate the cost of this two days a year of dental floss needed.

Expert

The student makes appropriate assumptions needed in solving the task.

The student creates an accurate and appropriate math representation.

The Cavity-Less Caper

I am assuming that Daisy will live for 70 years. She uses dental floss once every day. Her mother will live for 70 years.

The first thing that I am going to do is make a kind of chart and try to figure out how much it will cost for 200 yards of floss - every kind. Then, I can figure out the best price.

Kind of dental floss	Reg. Price	Approx. price - 200 yards
unwaxed - 63 yards	$1.19	$3.78
waxed mint or cinnamon - 50 yards	$1.09	$4.36
waxed - 100 yards	$2.49	$4.98
waxed mint - 100 yards	$.99	$1.98 - best price
unwaxed or waxed - 100 yards	$1.39	$2.78
waxed - 200 yards	$3.79	$3.79
Natural Flossing Ribbon - 30 yards	$3.59	$23.93

WOW!

To figure out how much 200 yards of dental floss would cost, I multiplied the original price by how many times the amount of yards would go into 200 yards.

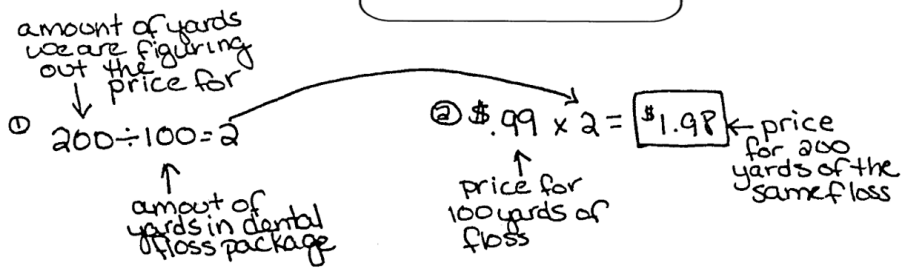
example: waxed mint - 100 yards. price - $.99.

The student goes beyond the task requirements and determines the best buy.

Expert

The student labels all of his/her work.

a.



I am assuming that Daisy uses waxed dental floss usually, but uses the unwaxed floss she gets at Christmas. I am also assuming that she wants the best priced dental floss.

As we can see from the chart, the best priced dental floss (which is also waxed) is waxed mint -100 yards. The price is $.99 (or $1.98 for 200 yards).

Now, I am going to figure out how much dental floss (and the cost) Daisy will use in one year. First, I will figure out what she is given.

Facts:
- Price of dental floss: 99¢ for 100 yards (waxed mint)
- amount of waxed floss used per day: 18 inches
- days in year: 365 days
- number of times she flosses: once per day
- number of inches in 1 yard: 36 inches
- twice a year, Daisy gets dental floss from her dentist - 50 yards, waxed, cinnamon

The student communicates facts necessary in solving the problem.

Expert

The student presents the solution in a logical sequential order.

- once a year, her mother gives Daisy 100 yards, unwaxed.
- Daisy uses 22 inches unwaxed floss.

days the dentist's floss will last:

yards in floss → 50 x 36 = 1800 ÷ 18 = 100 ← days will last

(50 x 36: inches in yard; 1800: inches in 50 yards; 18: inches used in day)

NOTE: Daisy gets the dentist's floss twice a year

days mom's floss will last:

100 x 36 = 3600 ÷ 22 = 163 ← days will last

Now we know how many days the dentist's and mother's floss will last. We have to remember that Daisy gets the dentist's floss twice a year, and the mothers once (while she is alive).

This is how many days in a year the dentist's and mother's floss will last:

days dentist's floss will last → 100 x 2 = 200 + 163 = 363 days in a year (will last)

(2 = gets it 2 times a year; 163 = days mom's lasts)

So, when her mother is alive, Daisy will only have to pay about 1¢ a year for dental floss.

This is how much Daisy's dental floss will cost:

(turn page)

Expert

The student continues to communicate clearly and in detail.

She is using: waxed mint, 100 yards $.99

① $100 \times 36 = 3600 \div 18 = \boxed{200}$ ← days floss will last

(100 ↑ yards in floss; 36 ↑ inches in yard; 18 ↑ inches of floss used in day)

② To figure out cost per day:

$.99 \div 200 = \boxed{.495¢}$ ← cost per day (less than 1¢ for 2 days)

(.99 ↑ cost of floss; 200 ↑ days floss will last)

Daisy is 20 years old and lives until she is 70 years old. That means, she has to buy floss for 50 years: $70-20=\boxed{50}$

Daisy's mother is 45 years old and lives until she is 70 years also. She will live and be able to give Daisy dental floss for 25 more years: $70-45=\boxed{25}$

To figure out how many years Daisy won't get floss from her mother, we can subtract how many more years the mother will live from how many Daisy will live: $50-25=\boxed{25}$

Now we have to figure out how much floss and the cost of it for the 25 years she won't get floss from her mother.

Expert

days that the dentist's floss will last: 200 days (see page 3-remember- she gets the dentist's floss 2 time a year)

I will subtract 200 from 365 (days in year) to see how many days, when the mother is dead, Daisy will have to buy floss (in one year)

365 - 200 = 165 ← days Daisy has to buy floss in one year

Total number of days she must buy her own floss:

165 x 25 = 4125 ← total # days Daisy must buy own floss

↑ days Daisy won't get mom's floss (See page 4)

How much it will cost her:

Student demonstrates an understanding of the real life circumstance.

① 4125 ÷ 200 = ≈21 ← number of packages Daisy must buy

↑ total # days she must buy own floss

↓ days floss lasts (see page 4)

② $.99 x 21 = $20.79 ← how much dental floss Daisy has to buy in her life (not completely done yet!)

↑ price of dental floss

↑ number of packages Daisy must buy

Now I have to add on to $20.79 how much it costs her when her mother is alive - 1¢ a year, for 25 years (see page 4)

$.01 x 25 = $.25

TURN PAGE

I can't add on 25¢ to $20.79, because you can't by part of a package of dental floss. One pack costs $.99 so:

$20.79 + .99 = $26.78 ← This is how much Daisy will spend on dental floss

Expert

in her entire life!

Answer:
$26.78

P.S. This problem has a lot of
little tricks. If Dad hadn't
asked me how long the mother
would live (which I had forgotten about),
I wouldn't have had to go to LOTS of
trouble!